

1 SPECIFICATION

2 TITLE OF INVENTION

3 Method and device for introducing state changes into athletic activities.

4 CROSS-REFERENCE TO RELATED APPLICATIONS

5 Not Applicable.

6 STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR

7 DEVELOPMENT

8 Not Applicable.

9 REFERENCE TO SEQUENCE LISTING , A TABLE, OR A COMPUTER PROGRAM

10 LISTING COMPACT DISK APPENDIX

11 Not Applicable.

12 BACKGROUND OF THE INVENTION.

13 Most athletic activities require the participants to respond rapidly to changes in
14 their environment. For instance, they must constantly reevaluate their course of action
15 depending upon their own velocity and position and that of a ball, opposing players, and
16 teammates. However in training, and especially in solo training, the environment tends to
17 be largely static. In the game known as soccer in the U.S.A, and football elsewhere, a
18 common training drill consists of a player dribbling a ball around a series of cones or
19 other similar markers. Such variation as exists consists of predetermined decisions such
20 as to alternate between passing on the left on one cone and on the right on the next.
21 Effectively such training exists within an invariant environmental state.

1 The disadvantage of such a drill is that it does not train athletes to constantly
2 observe, analyze, and react, as they must in a real game. The present invention allows
3 the introduction of transitions between multiple environmental states, such transitions
4 being either strictly periodic or randomly varying in frequency, enabling in training
5 situations a better simulation of the timing and thought processes of the game in question.
6 The invention also allows new types of games to be created and played which incorporate
7 the varying states expressed by the device into the play of the game. The invention
8 accomplishes these goals by maintaining a time varying internal state which is transmitted
9 to athletes, typically via a visual method such as colored lights, so that the athletes may
10 interpret these signals as a change in the training or game environment. In the soccer
11 training drill the invention would replace the traditional practice cone and would indicate
12 to the player the manner in which the ball should be passed around the obstacle.

13 The intentional introduction of transitions between multiple contest states is
14 common in arcade and video games and other electronic entertainment but there is little
15 precedent for this in athletics. The only common examples occur at or before the actual
16 contest: the opening toss of a coin before a game or the drop of the flag in an automobile
17 race. In music the periodic signal from a metronome is often used and there may be
18 instances where the signal from such a metronome has been used to aid athletes
19 synchronize their movements to music. That differs from the utility of the present
20 invention, which is not synchronization, but the presentation of varying training or game
21 states to the athlete.

1 The following U.S. patents disclose concepts that bear some relation to the present
2 invention. However, none of the cited prior art discloses an invention having the
3 versatility or utility of the present invention.

4 Stuler U.S. Pat. No. 3,629,600 discloses a battery powered traffic light controller.
5 This and other traffic controllers differ markedly from the device of the current patent
6 application. Such controllers transition between their 3 states (green,yellow,red) in a
7 single fixed order. Additionally, these transitions are either triggered by external sensors
8 or occur at fixed time intervals. The present invention does not use external sensors to
9 trigger state transitions. Instead, a large repertoire of randomly varying state transitions
10 useful in athletic training are provided. The traffic controllers would be predictable and
11 useless for injecting variation into athletic training. Conversely, the device of the present
12 patent, when configured appropriately for athletic training, would lead to havoc if utilized
13 as a traffic controller.

14 Ramsey U.S. Pat. No. 5,325,340 discloses an athletic training device which is
15 utilized for pacing. Its function is the antithesis of that of the device of the present patent
16 application. The pacing device produces a certainty. It tells the athlete exactly where to
17 be at a given time and even goes so far as to provide a correction signal when the athlete
18 is too far ahead or behind. The present device produces an uncertainty. Its purpose is to
19 present a signal which is variable and unpredictable. Moreover, the feedback circuit of
20 Ramsey's device requires a measurement of the athlete's position. No such measurement
21 is required or supported by the present invention.

1 Goldfarb et al. U.S. Pat. No. 3,933,354 discloses a martial arts amusement device
2 in which a light at one of ten positions on a picture of a combatant is lit. When a player
3 strikes that position the light turns off, the player's score is incremented, and the game
4 lights another region on the simulated combatant. The lights are selected from a pattern
5 sufficiently complex to appear in random order to the player. This is a one or two player
6 game. This invention is primarily a game rather than a serious athletic training device
7 and it is described in very narrow terms without any general application to other types of
8 athletic training or contests. This invention requires constant input from the player - the
9 game will lock in any device state where a lamp is lit unless the player strikes the lit part
10 of the display to allow it to transition to the next state. The designers recognized that a
11 detector failure would render the game inoperable and provided a failsafe mechanism to
12 transition should that occur - but such a transition is not a normal operating mode of the
13 invention. In comparison, the invention of the present patent application, as it might be
14 implemented for martial arts practice, would have lit one or more lamps for short periods
15 of varying duration during which a lit lamp would have been a target for the athlete. The
16 device would then have transitioned to another device state whether or not the athlete
17 succeeded in striking the ~~target~~-target(s). An alternative embodiment, which could be
18 used with existing training dummies, would dispense with the lamps entirely and instead
19 announce the targets through a speaker.

20 Elstein et al. U.S. Pat. No. 4,702,475 disclose a sports technique and reaction
21 training system in which a particular movement pattern is to be executed by the

1 participant in a given amount of time in response to a start signal that determines which
2 of several such patterns is to be executed. This invention requires that the participant
3 return to a base position to trigger another training cycle - so that the time required to
4 complete the movement pattern may be measured. Moreover, the purpose of the
5 invention is to train the participant to carry out a choreographed set of motions in
6 minimal time. The present invention is very different. Some of the differences are: the
7 position of the athlete with respect to the device is not fixed (there are no intrinsic start
8 and stop positions); the device runs independently of the athlete's actions (other than
9 setting it and turning it on, the athlete would not normally affect the state of the device);
10 more than one device could be simultaneously employed in training or during a game by
11 an athlete or athletes; and the utility of the invention is to provide state transitions in
12 training to better simulate actual play, or in play, to provide more variety to the game, but
13 not to improve the performance of a predetermined choreographed set of motions.

14 Other instances of the class of athletic measurement devices examined in detail in
15 the preceding paragraph are disclosed in Mackovjak U.S. Pat. No. 5,897,457, Guillen
16 U.S. Pat. N. 6,066,105, and Feiner et al. U.S. Pat. No. 6,278,378. These devices all differ
17 from the present invention in requiring two trigger events: one to initiate a measurement
18 and second one to indicate its termination. The devices then report the performance in
19 some manner. The present invention utilizes no triggers, does not measure performance
20 in any way, and is used in an altogether different manner than any of these devices.

1 Eger U.S. Pat. No. 5,812,239 discloses a visual training device comprising a
2 plurality of LEDs under microprocessor control, and in some embodiments, sensors
3 and control arranged around a central hole that in some embodiments holds additional
4 optics. In all embodiments the user stands at a fixed position with respect to the device
5 and looks at LEDs as they are lit. In some variations ofThe user looks through the hole
6 and focuses at infinity while simultaneously viewing the LEDs in the peripheral this
7 embodiment the user is further required to peer through special optics at the same
8 time-vision as they are lit. To do so the user's eyes must necessarily be centered on the
9 hole and offset back from the device at such a distance that the LEDs will appear in the
10 correct visual region. Effectively this fixes the location of the user's head with respect to
11 the device. This may be an exemplary device for training the eyes of eye training device
12 of utility in an optometrists office-athletes. However, a person standing in a fixed
13 position and rolling her eyes is not generally considered to be either training for, or
14 participating in, an athletic endeavor. Most critically in its most basic form this device
15 neither elicits nor allows engaged in an athletic endeavor, even if such training is of some
16 utility later when she does participate in an athletic activity. These embodiments neither
17 elicit nor allow significant bodily motion and consequently has little have no utility in
18 athletic training. That this is an eye training device, rather than an athletic training
19 device, is further emphasized by those implementations employing colored filters
20 specifically to exercise different sets of retinal cells, which have different chromatic
21 sensitivities.

1 ~~The~~Eger also discloses more active embodiments ~~disclosed that~~ are designed to
2 measure reaction time and accuracy in response to the ~~same~~ visual stimulus. As such,
3 ~~these require at least one sensor, which acts as a trigger, and~~ have triggers and other
4 features as described above for other similar measurement devices, and so differ in
5 fundamental ways from the present invention.

6 Eger does not disclose in any embodiment or method the concept of changing the
7 state of the athletic environment. Reactions, if any, are always targeted back to the device
8 itself, and specifically to the signaling lamp, such action serving to confirm that the
9 light's stimulus was perceived, and in some cases to measure the speed and accuracy of
10 that response. This differs fundamentally from the present device which informs the
11 athlete of a change in the training or game environment with the athlete's subsequent
12 response being in that context, and being generally external to, and unrelated to, the
13 presence of the device itself. For instance, in a baseball pitching exercise the present
14 device might be located between the pitcher's mound and home plate and would indicate
15 that the ball should be thrown to a particular base or to home plate, all of which are
16 traditional targets in this athletic context. However, the present device would not itself
17 become the target of the directed action. Similarly, replacing an inert cone with a cone
18 shaped embodiment of the present device in a soccer dribbling drill would add variation
19 to an otherwise static practice but it would not change the nature of the cone in that drill
20 by converting it into a target.

1 BRIEF SUMMARY OF THE INVENTION

2 This device is to be employed in the training of athletes and the playing of athletic
3 games. During these activities athletes observe and respond to signals that vary with time
4 and are generated and displayed by the device. In this manner the device adds a new
5 element to athletic training and enables new types of sports to be played.

6 SUMMARY OF THE INVENTION

7 The present device provides for one or more logical states to be continuously
8 varied, either periodically or randomly, and for this state information to be transmitted to
9 one or more athletes for the purpose of varying the training or game environment. The
10 athlete would perceive this information either visually or aurally as appropriate for each
11 sport. For a specific example consider again the soccer drill described above. This
12 device would either adorn or replace the typical cone marker and would maintain an
13 ~~integer variable~~ via electronic means two binary variables which would transition ~~between~~
14 ~~its four allowed states in a periodic, random, or pseudorandom~~ On and Off in a periodic or
15 random pattern. This information would be conveyed to the athlete visually - for
16 instance, by providing two rings of light around the cone, one blue, one red, which are lit
17 according to the value of the matching state variable. Together these two ~~state~~ variables
18 would encode four device states with the local (to this cone) meanings "Pass on Left",
19 "Pass on Right", "Pass on Left or Right", and "Do not Pass". Pass". The time fraction the
20 device spends in each state would be adjustable, as would be the mean frequency of the
21 transitions between these device states and the minimum hold time spent in each device

1 state before a transition would be permitted. An athlete approaching the cone would
2 observe the state of the device and respond as appropriate. Even this simple four state
3 training device could easily be employed in numerous other drills in this and other sports.
4 For instance, the same four state device placed at the top of the basketball key could
5 indicate "left side layup", "right side layup", "shoot from the top of the key", or "shoot
6 immediately." In baseball it might tell a pitcher to throw a curve, slider, fastball, or to
7 throw out the runner at first base. The invention may also be used to globally alter the
8 rules of the athletic contest or practice. Examples: "when the red light is lit players may
9 not shoot on goal" or "player number 5 may shoot".

10 BRIEF DESCRIPTION OF THE DRAWINGS

11 The manifestation of the present invention will necessarily vary depending upon
12 the particular sport ~~it is applied to~~. This is particularly true when considering aquatic
13 versus terrestrial playing environments. To illustrate this invention a preferred
14 embodiment is presented for use in the context of a terrestrial game like soccer.

15 Figure 1 Side view of the exterior of the preferred embodiment.

16 Figure 2 Block diagram of the mechanism of the preferred embodiment.

17 ~~Figure 3A. Block diagram of a line powered remote controller with microphone,~~
18 ~~speaker, and transmitter receiver.~~

19 ~~Figure 3B. Block diagram of a display unit with microphone, speaker, symbolic~~
20 ~~display, and transmitter receiver.~~

21 ~~Figure 4A. Alphanumeric display unit worn by athlete.~~

1 ~~Figure 4B. Alphanumeric display unit attached to a piece of sports equipment.~~

2 ~~Figure 5. Multiple display units with a single remote controller.~~

3

4 Reference Numerals Used in the Drawings:

5 10. Ring of Red Light Emitting Diodes

6 20. Ring of Blue Light Emitting Diodes

7 30. Plastic Cone

8 40. Removable Battery

9 50. Electronic Controller

10 60. Power Switch

11 70. Frequency Dial

12 80. Hold Time Dial

13 90. DIP Switch DP1

14 100. DIP Switch DP2

15 ~~110. Line Power~~

16 ~~120. Speaker~~

17 ~~130. Microphone~~

18 ~~140. Transmitter receiver~~

19 ~~150. Symbolic Display~~

20 ~~160. Alphanumeric Display~~

21 ~~170. Wearable case.~~

- 1 ~~180.—Attachable case.~~
- 2 ~~190.—Article of sporting equipment.~~
- 3 ~~200.—Athletic field with a plurality of display units~~
- 4 ~~210.—Current Device State of Remote Controller~~
- 5 ~~220.—Remote Controller~~
- 6 ~~230.—Display state.~~
- 7 ~~240.—Athlete~~
- 8 ~~250.—Transmission from remote controller to display units~~
- 9 ~~260.—Display unit~~
- 10 ~~270.—Communications selector~~
- 11 ~~280.—Previous Device State of Remote Controller~~

12
13 DETAILED DESCRIPTION OF THE DRAWINGS.

14 Figure 1 is a drawing of the exterior of the preferred embodiment of the invention.
15 There are two rings of colored light emitting diodes (LED's) on the device, a red one
16 located near the cone's tip **10** and a blue one **20** located near the middle of the cone. The
17 remainder of the exterior of the device is composed of a strong and durable plastic case
18 **30** in a contrasting color such as yellow or light orange.

19 ~~In this description the term "device state" refers to the value maintained by the~~
20 ~~device of a specific integer number which is encoded by at least one bit. In this first~~
21 ~~embodiment this integer has two bits and so the device state can takes one of four values.~~

~~A transition is when the device state takes any of the four allowed values, including the one it had previously. The device "changes state" when it moves from one of these four allowed values to a different allowed value.~~

Figure 2 shows a block diagram of the mechanism. A removable battery 40 provides power. It is connected to a small electronic ~~module 50.~~ This module controller 50. This is a typical embedded microprocessor based controller that reads its program from internal read only memory. When power is applied via an ON/OFF switch 60, and at one second intervals thereafter, the controller reads the desired device settings ~~from the configuration devices, two dials 70, 80 and 70, 80, and from~~ a pair of 8 position DIP switches DP1, DP2 90, 100, and uses its internal program, ~~the value of the device state,~~ and this setting information to drive the red 10 and blue 20 sets of display LEDs. The Frequency Dial 70 controls the mean frequency at which the device may change state, which can be varied between 600 transitions per minute and 0.1 transitions per minute. The Hold Time Dial 80 sets the minimum hold time a device state must be maintained before a state transition is allowed and is variable between 200 milliseconds and 5 minutes. The switches on DP1 90 and DP2 100 control the device in the following manner:

DP1,0 determines if the transitions are periodic (fixed rate) or randomly varying around a mean frequency.

DP1,1 determines the device state order as sequential {0,1,2,3,0...} or random.

DP1,2-4 determine the occupancy for device state 0

1 DP1,5-7 determine the occupancy for device state 1

2 DP2,0-1 unused

3 DP2,2-4 determine the occupancy for device state 2

4 DP2,5-7 determine the occupancy for device state 3

5

6 The occupancy values set on DP1 90 and DP2 100 are integers in the range 0
7 through 7. The total occupancy for the system is the sum of the four device state
8 occupancies. For instance, if these values were 0,5,3,2 (for states 0 through 3,
9 respectively) the device would never enter state 0, would spend 50% of its time in state 1,
10 30% in state 2, and 20% in state 3. To vary only between states 1 and 2, and spend equal
11 time (on average) in each the setting would be 0,N,N,0 where N is between 1 and 7.

12 When used in the soccer dribbling drill application a typical setting might be: random
13 transitions with a mean frequency of 15 transitions per minute, a minimum hold time of
14 .5 seconds, random transition order, and occupancies set to 2,7,7,2. It is assumed that
15 situations will arise where the invention will also be used as a static marker in fixed state.
16 To lock the device into state 2 the occupancy values would be set at 0,0,7,0.

17 ~~When used in the soccer dribbling drill application a typical setting might be:~~
18 ~~random transitions with a mean frequency of 15 transitions per minute, a minimum hold~~
19 ~~time of .5 seconds, random device state order, and occupancies set to 2,7,7,2. The mean~~
20 ~~period (MP) is the inverse of the mean frequency. Here the hold time (HT) of 0.5s is less~~
21 ~~than the MP of 4s, so a random number (RN) valued in seconds between 0 and 2*(MP-~~

1 HT), here ~~7s~~, is generated by the controller. The next transition is then calculated at HT
2 ~~+ RN~~ seconds later. If HT had been more than MP the time offset to the next transition
3 would have been equal to MP. When a transition is determined a second random number
4 between 1 and 18 (the total occupancy) is generated by the controller. The next device
5 state is then determined by this random value as follows: 0 for {1,2}, 1 for
6 {3,4,5,6,7,8,9}, 2 for {10,11,12,13,14,15,16}, 3 for {17,18}.

7 Table 1 shows the states of the signal lights and their interpretation by the athlete.
8 The first column indicates the state of the red LEDs, the second column the state of the
9 blue LEDs, the third column the device state, and the fourth column indicates the
10 interpretation of the device state to be made by the athlete within the context of a soccer
11 dribbling drill.

12 TABLE 1

Red Lights	Blue Lights	Device State	Meaning to player
off	off	0	Do not pass
on	off	1	Pass on right side
off	on	2	Pass on left side
on	on	3	Pass on either side

13

14 Figure 3A shows a block diagram of an alternative embodiment where the remote
15 controller comprises a line power source ~~110~~ and switch ~~60~~, electronic controller ~~50~~,
16 Frequency ~~70~~ and Hold Time ~~80~~ Dials, two DIP switches ~~90, 100~~, speaker ~~120~~, and
17 microphone ~~130~~. These are physically separate from the display unit described below in
18 Figure 3B and communicate with it via a transmitter receiver ~~140~~. The logical operation

1 ~~of the device is as described above except that the electronic controller 50 in this~~
2 ~~embodiment also acts to record and transmit sounds detected by the microphone 130~~
3 ~~through the transmitter receiver 140, and to play sounds received through the transmitter~~
4 ~~receiver 140 on the speaker 120.~~

5 ~~Figure 3B shows a block diagram of an alternative embodiment of the display~~
6 ~~unit, comprising a battery power source 40 and switch 60, speaker 120, microphone 130,~~
7 ~~symbolic display 150, and a transmitter receiver 140. The components act substantially~~
8 ~~as described above except that the electronic controller 50 in the display unit simply~~
9 ~~relays the device state information of the remote controller of Figure 3A to the symbolic~~
10 ~~display 150, which replaces the LED rings of Figure 1 and Figure 2. The four device~~
11 ~~states of Table 1 would be displayed here as symbols, one of which is shown in the~~
12 ~~figure, indicating by the left arrow that the player must go left.~~

13 ~~Figure 4A shows an alternative embodiment of the display unit as a device~~
14 ~~wearable by the athlete. This device is logically identical to the embodiment of Figure 3B~~
15 ~~except that the symbolic display 150 has been replaced by an alphanumeric display 160.~~
16 ~~That is, instead of a left arrow the alphanumeric display 160 shows text, in the figure,~~
17 ~~"Pass on Left". A wearable case 170 in this embodiment allows the athlete to don the~~
18 ~~device, which, of course, could also be carried. The design of the case will necessarily~~
19 ~~vary considerably from sport to sport. Here the case 170 is shown fastened to the athlete's~~
20 ~~wrist.~~

1 ~~Figure 4B shows an alternative embodiment of the display unit as a device~~
2 ~~attached to an article of athletic equipment 190. The exact design of the attachable case~~
3 ~~180 will necessarily vary with the type of equipment it is to be attached to. Here the case~~
4 ~~shown is substantially the same as the wearable case 170 of Figure 4A, which being~~
5 ~~suitable for attachment to a wrist, will also be suitable for attaching to cylindrical~~
6 ~~equipment of roughly the same diameter as a human wrist.~~

7 ~~Figure 5 shows an alternative embodiment where a plurality of display units 260~~
8 ~~are arrayed on an athletic field 200 and are controlled from a single remote controller 220.~~
9 ~~In the training exercise illustrated the athlete 240 moves to guard the single blue lit~~
10 ~~display unit and ignores any other lit display units. Externally each display unit 260~~
11 ~~resembles the entire device of Figure 1 and comprises a ring of red LEDs 10, a ring of~~
12 ~~blue LEDs 20, a durable plastic case 30, and an additional component, a transmitter~~
13 ~~receiver 140. Internally the display units are logically essentially as described in Figure~~
14 ~~3B, in this instance with the minor substitution of rings of LEDs 10, 20 for the symbolic~~
15 ~~display 150 of Figure 3B.~~

16 ~~The display state 230 of each display unit 260 corresponds to a portion of the~~
17 ~~device state 210 of the remote controller 220. For this illustration the current device state~~
18 ~~210 of the remote controller 220 is presented as 9 values of 2 bits each and their 1:1~~
19 ~~correspondence via the logic of Table 1 to the current display state 230 of the various~~
20 ~~display units 260 is evident. The preceding device state 280 is also shown. In the~~
21 ~~preceding moment the central display unit was blue. Following a device state change the~~

1 athlete is moving to guard the display unit which is currently blue, having ignored in both
2 instances the single red display unit. The device state is transmitted 250 via the
3 transmitter receiver 140 to the plurality of display units on the field 200, each of which
4 then takes on the display state 230 which corresponds to its portion of the device state
5 210. There are numerous well known methods available for dynamically mapping parts
6 of the device state 210 to particular display units 260. In this simple embodiment static
7 mapping is employed: this information is set in the controller inside each display unit at
8 the time of manufacture.

9 The remote controller 220 is essentially the same as that shown in Figure 3A, with
10 a few minor enhancements to allow it to control more than one display unit at a time. One
11 possible arrangement of the exterior features is presented showing the speaker 120,
12 microphone 130, power switch 60, transmitter receiver 140, and the configuration
13 devices. The configuration devices include the Frequency dial 70, Hold time Dial 80,
14 DIP switches DP1 90 and DP2 100, and the large DIP switch which is the
15 communications selector 270. Several training options programmed into the controller
16 provide a variety of exercises. To toggle between these modes the previously unused DIP
17 switches DP2,0 and 1 are now employed to set the controller as described in Table 2.

18 TABLE 2

DP2,0	DP2,1	Device State
open	open	All display units transition together to the same state.
closed	open	Each display unit transitions independently
open	closed	Display unit transition sequentially
closed	closed	Cycle between preprogrammed sequential actions

1

2 ~~The first of these modes is equivalent to a single device of Figure 1 reflected on~~
3 ~~the field multiple times. The second mode is equivalent to the deployment on the field of~~
4 ~~multiple independent instances of the device of Figure 1. The third mode activates~~
5 ~~display units sequentially in a predefined or random order so as to present a localized~~
6 ~~signal that moves in a one, two, or three dimensional pattern across a playing area. As in~~
7 ~~the device of Figure 1, the randomly timed transitions prevent the athlete from predicting~~
8 ~~the moment when the next change will occur. In Figure 5 the athlete on the field moves~~
9 ~~to "guard" the single blue cone, where the order in which the cones are lit simulates the~~
10 ~~erratic motions of a moving offensive player. The fourth mode cycles slowly through the~~
11 ~~activation patterns which are available for the third mode. The controller stops cycling,~~
12 ~~locking in the current pattern, when DP2,0 is set back to the open.~~

13 ~~The communications selector (CS) 270 is read by the controller in a manner~~
14 ~~similar to the other DIP switches. The CS allows communications to be selectively~~
15 ~~targeted to any subset of the display units or broadcast to all of them. The CS has a~~
16 ~~plurality of switches. When CS 0 is set broadcast is enabled allowing sound~~
17 ~~communication with all devices. When CS 0 is not set communication is selectively~~
18 ~~controlled by the other CS switches. For instance, when CS 1 is set sound~~
19 ~~communication with the first display unit is enabled, otherwise, it is disabled.~~
20 ~~One preferred embodiment and several variations of the device have~~example of the
21 invention has been described here in detail to comply with the Patent Statutes and to

Appl. No. : 10/025,310 Marked amended specification vs. 1st amendment
Amdt. dated Mar 5, 2004
Reply to the Office Action of Dec 23, 2003

1 prove that this device could be constructed by one skilled in the arts. It is emphasized
2 that numerous other implementations of the invention are possible, none of which depart
3 from the scope of the invention itself. These include, but are not limited to: utilizing
4 similar or different implementation technologies; utilizing similar or different
5 implementation details, especially presentation of the state to the athlete via alternative
6 means such as symbolic or alphanumeric displays, or synthesized sounds or speech;
7 customizing for one or more different sports; utilizing more or fewer device states; and
8 utilizing physically larger or smaller devices; utilizing multiple independent devices
9 simultaneously on the athletic field; utilizing devices which are carried by the athletes or
10 attached to athletic equipment; utilizing remote control of multiple devices which all
11 display the same state; ~~devices-~~utilizing remote control of multiple devices which display
12 different states; utilizing multiple remote devices which are activated sequentially in a
13 predefined or randomly selected in order to simulate, for instance, the motions of another
14 player; and providing in addition to the display of device state information the selective
15 or broadcast relaying of communications from coaches, referees, or other players.

1 ABSTRACT OF THE DISCLOSURE

2 A device is described for introducing variation in athletic training and competitive
3 events. This device maintains an internal state ~~which~~that occupies one of several allowed
4 values. Depending upon the selected configuration, the device changes internal state at
5 regular or irregular intervals, progresses through its allowed values sequentially or in
6 random order, and spends a different designated fraction of time in each state. This
7 variable and typically unpredictable state is ~~transmitted or~~ presented to the field of play
8 where one or more athletes receive the information and react to it as a change in their
9 athletic training or game ~~environment. One environment, form of the device coordinates~~
10 ~~multiple independent displays so that the signal corresponding to the internal state~~
11 ~~appears to move from display to display across the field of play~~

12
13

Appl. No. : 10/025,310 Marked amended specification vs. initial application
Amdt. dated Mar 5, 2004
Reply to the Office Action of Dec 23, 2003

1

2 U.S. PATENT DOCUMENTS CITED:

3

4 U.S. Patent No. 3,629,600: EMERGENCY TRAFFIC LIGHT CONTROLLER

5

6 U.S. Patent No. 3,933,354: REFLEX TESTING AMUSEMENT DEVICE

7

8 U.S. Patent No. 4,702,475: SPORTS TECHNIQUE AND REACTION TRAINING
9 SYSTEM

10

11 U.S. Patent No. 5,325,340: PACING DEVICE

12

13 U.S. Patent No. 5,812,239: METHOD AND ARRANGEMENT FOR THE
14 ENHANCEMENT OF VISION AND/OR HAND-EYE COORDINATION

15

16 U.S. Patent No. 5,897,457: ATHLETIC PERFORMANCE MONITORING SYSTEM.

17

18 U.S. Patent No. 6,066,105: REFLEX TESTER AND METHOD FOR MEASUREMENT

19

20 U.S. Patent No. 6,287,378 B1: PERFORMANCE AND ENTERTAINMENT DEVICE
21 AND METHOD OF USING THE SAME

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16 teammates. However in training, and especially in solo training, the environment tends to
17 be largely static. In the game known as soccer in the U.S.A, and football elsewhere, a
18 common training drill consists of a player dribbling a ball around a series of cones or
19 other similar markers. Such variation as exists consists of predetermined decisions such
20 as to alternate between passing on the left on one cone and on the right on the next.
21 Effectively such training exists within an invariant environmental state.

1 The disadvantage of such a drill is that it does not train athletes to constantly
2 observe, analyze, and react, as they must in a real game. The present invention allows
3 the introduction of transitions between multiple environmental states, such transitions
4 being either strictly periodic or randomly varying in frequency, enabling in training
5 situations a better simulation of the timing and thought processes of the game in question.
6 The invention also allows new types of games to be created and played which incorporate
7 the varying states expressed by the device into the play of the game. The invention
8 accomplishes these goals by maintaining a time varying internal state which is transmitted
9 to athletes, typically via a visual method such as colored lights, so that the athletes may
10 interpret these signals as a change in the training or game environment. In the soccer
11 training drill the invention would replace the traditional practice cone and would indicate
12 to the player the manner in which the ball should be passed around the obstacle.

13 The intentional introduction of transitions between multiple contest states is
14 common in arcade and video games and other electronic entertainment but there is little
15 precedent for this in athletics. The only common examples occur at or before the actual
16 contest: the opening toss of a coin before a game or the drop of the flag in an automobile
17 race. In music the periodic signal from a metronome is often used and there may be
18 instances where the signal from such a metronome has been used to aid athletes
19 synchronize their movements to music. That differs from the utility of the present
20 invention, which is not synchronization, but the presentation of varying training or game
21 states to the athlete.

1 The following U.S. patents disclose concepts that bear some relation to the present
2 invention. However, none of the cited prior art discloses an invention having the
3 versatility or utility of the present invention.

4 Stuler U.S. Pat. No. 3,629,600 discloses a battery powered traffic light controller.
5 This and other traffic controllers differ markedly from the device of the current patent
6 application. Such controllers transition between their 3 states (green,yellow,red) in a
7 single fixed order. Additionally, these transitions are either triggered by external sensors
8 or occur at fixed time intervals. The present invention does not use external sensors to
9 trigger state transitions. Instead, a large repertoire of randomly varying state transitions
10 useful in athletic training are provided. The traffic controllers would be predictable and
11 useless for injecting variation into athletic training. Conversely, the device of the present
12 patent, when configured appropriately for athletic training, would lead to havoc if utilized
13 as a traffic controller.

14 Ramsey U.S. Pat. No. 5,325,340 discloses an athletic training device which is
15 utilized for pacing. Its function is the antithesis of that of the device of the present patent
16 application. The pacing device produces a certainty. It tells the athlete exactly where to
17 be at a given time and even goes so far as to provide a correction signal when the athlete
18 is too far ahead or behind. The present device produces an uncertainty. Its purpose is to
19 present a signal which is variable and unpredictable. Moreover, the feedback circuit of
20 Ramsey's device requires a measurement of the athlete's position. No such measurement
21 is required or supported by the present invention.

1 Goldfarb et al. U.S. Pat. No. 3,933,354 discloses a martial arts amusement device
2 in which a light at one of ten positions on a picture of a combatant is lit. When a player
3 strikes that position the light turns off, the player's score is incremented, and the game
4 lights another region on the simulated combatant. The lights are selected from a pattern
5 sufficiently complex to appear in random order to the player. This is a one or two player
6 game. This invention is primarily a game rather than a serious athletic training device
7 and it is described in very narrow terms without any general application to other types of
8 athletic training or contests. This invention requires constant input from the player - the
9 game will lock in any device state where a lamp is lit unless the player strikes the lit part
10 of the display to allow it to transition to the next state. The designers recognized that a
11 detector failure would render the game inoperable and provided a failsafe mechanism to
12 transition should that occur - but such a transition is not a normal operating mode of the
13 invention. In comparison, the invention of the present patent application, as it might be
14 implemented for martial arts practice, would have lit one or more lamps for short periods
15 of varying duration during which a lit lamp would have been a target for the athlete. The
16 device would then have transitioned to another device state whether or not the athlete
17 succeeded in striking the ~~target~~-target(s). An alternative embodiment, which could be
18 used with existing training dummies, would dispense with the lamps entirely and instead
19 announce the targets through a speaker.

20 Elstein et al. U.S. Pat. No. 4,702,475 disclose a sports technique and reaction
21 training system in which a particular movement pattern is to be executed by the

1 participant in a given amount of time in response to a start signal that determines which
2 of several such patterns is to be executed. This invention requires that the participant
3 return to a base position to trigger another training cycle - so that the time required to
4 complete the movement pattern may be measured. Moreover, the purpose of the
5 invention is to train the participant to carry out a choreographed set of motions in
6 minimal time. The present invention is very different. Some of the differences are: the
7 position of the athlete with respect to the device is not fixed (there are no intrinsic start
8 and stop positions); the device runs independently of the athlete's actions (other than
9 setting it and turning it on, the athlete would not normally affect the state of the device);
10 more than one device could be simultaneously employed in training or during a game by
11 an athlete or athletes; and the utility of the invention is to provide state transitions in
12 training to better simulate actual play, or in play, to provide more variety to the game, but
13 not to improve the performance of a predetermined choreographed set of motions.

14 Other instances of the class of athletic measurement devices examined in detail in
15 the preceding paragraph are disclosed in Mackovjak U.S. Pat. No. 5,897,457, Guillen
16 U.S. Pat. N. 6,066,105, and Feiner et al. U.S. Pat. No. 6,278,378. These devices all differ
17 from the present invention in requiring two trigger events: one to initiate a measurement
18 and second one to indicate its termination. The devices then report the performance in
19 some manner. The present invention utilizes no triggers, does not measure performance
20 in any way, and is used in an altogether different manner than any of these devices.

1 Eger U.S. Pat. No. 5,812,239 discloses a visual training device comprising a
2 plurality of LEDs under microprocessor control arranged around a central hole that in
3 some embodiments holds additional optics. The user looks through the hole and focuses
4 at infinity while simultaneously viewing the LEDs in the peripheral vision as they are lit.
5 To do so the user's eyes must necessarily be centered on the hole and offset back from the
6 device at such a distance that the LEDs will appear in the correct visual region.
7 Effectively this fixes the location of the user's head with respect to the device. This may
8 be an exemplary device for training the eyes of athletes. However, a person standing in a
9 fixed position and rolling her eyes is not engaged in an athletic endeavor, even if such
10 training is of some utility later when she does participate in an athletic activity. These
11 embodiments neither elicit nor allow significant bodily motion and consequently have no
12 utility in athletic training. That this is an eye training device, rather than an athletic
13 training device, is further emphasized by those implementations employing colored filters
14 specifically to exercise different sets of retinal cells, which have different chromatic
15 sensitivities.

16 Eger also discloses more active embodiments that are designed to measure
17 reaction time and accuracy in response to the visual stimulus. As such, these have
18 triggers and other features as described above for other similar measurement devices, and
19 so differ in fundamental ways from the present invention.

20 Eger does not disclose in any embodiment or method the concept of changing the
21 state of the athletic environment. Reactions, if any, are always targeted back to the device

1 itself, and specifically to the signaling lamp, such action serving to confirm that the
2 light's stimulus was perceived, and in some cases to measure the speed and accuracy of
3 that response. This differs fundamentally from the present device which informs the
4 athlete of a change in the training or game environment with the athlete's subsequent
5 response being in that context, and being generally external to, and unrelated to, the
6 presence of the device itself. For instance, in a baseball pitching exercise the present
7 device might be located between the pitcher's mound and home plate and would indicate
8 that the ball should be thrown to a particular base or to home plate, all of which are
9 traditional targets in this athletic context. However, the present device would not itself
10 become the target of the directed action. Similarly, replacing an inert cone with a cone
11 shaped embodiment of the present device in a soccer dribbling drill would add variation
12 to an otherwise static practice but it would not change the nature of the cone in that drill
13 by converting it into a target.

1 BRIEF SUMMARY OF THE INVENTION

2 This ~~invention~~device is to be employed in the training of athletes and the playing
3 of athletic games. During these activities athletes observe and respond to signals that
4 vary with time and are generated and displayed by the ~~invention~~device. In this manner
5 the ~~invention~~device adds a new element to athletic training and enables new types of
6 sports to be played.

7 SUMMARY OF THE INVENTION

8 The present ~~invention~~device provides for one or more logical states to be
9 continuously varied, either periodically or randomly, and for this state information to be
10 transmitted to one or more athletes for the purpose of varying the training or game
11 environment. The athlete would perceive this information either visually or aurally as
12 appropriate for each sport. For a specific example consider again the soccer drill
13 described above. ~~The~~This ~~device in this case~~ would either adorn or replace the typical
14 cone marker and would maintain via electronic, ~~mechanical, optical, or other~~ means two
15 binary variables which would transition ~~between their~~ On and Off ~~states~~ in a ~~periodic,~~
16 ~~random, or pseudorandom~~ periodic or random pattern. This information would be
17 conveyed to the athlete visually - for instance, by providing two rings of light around the
18 cone, one blue, one red, which are lit according to the value of the matching state
19 variable. Together these two ~~state~~ variables would encode four device states with the
20 local (to this cone) meanings "Pass on Left", "Pass on Right", "Pass on Left or Right",
21 and "Do not ~~Pass~~". Pass". The time fraction the device spends in each state would be

adjustable, as would be the mean frequency of the transitions between these device states and the minimum hold time spent in each device state before a transition ~~was~~would be permitted. An athlete approaching the cone would observe the state of the device and respond as appropriate. Even this simple four state training device could easily be employed in numerous other drills in this and other sports. For instance, the same four state device placed at the top of the basketball key could indicate "left side layup", "right side layup", "shoot from the top of the key", or "shoot immediately." In baseball it might tell a pitcher to throw a curve, slider, fastball, or to throw out the runner at first base. The invention may also be used to globally alter the rules of the athletic contest or practice. Examples: "when the red light is lit players may not shoot on goal" or "player number 5 may shoot".

BRIEF DESCRIPTION OF THE DRAWINGS

The manifestation of the present invention will necessarily vary depending upon the particular sport ~~it is applied to~~. This is particularly true when considering aquatic versus terrestrial playing environments. To illustrate this invention a preferred embodiment is presented for use in the context of a terrestrial game like soccer.

Figure 1 ~~shows~~Side view of the exterior of the ~~invention as viewed from the side~~preferred embodiment.

Figure 2 ~~shows a block diagram of the mechanism~~Block diagram of the mechanism of the preferred embodiment.

Reference Numerals Used in the Drawings:

1 10. Ring of Red Light Emitting Diodes

2 20. Ring of Blue Light Emitting Diodes

3 30. Plastic Cone

4 40. Removable Battery

5 50. Electronic Controller

6 60. Power Switch

7 70. Frequency Dial

8 80. Hold Time Dial

9 90. DIP Switch DP1

10 100. DIP Switch DP2

11 DETAILED DESCRIPTION OF THE DRAWINGS.

12 Figure 1 is a drawing of the exterior of the preferred embodiment of the invention.

13 There are two rings of colored ~~LEDs~~light emitting diodes (LED's) on the device, a red
14 one located near the cone's tip 10 and a blue one 20 located near the middle of the cone
15 ~~20~~. The remainder of the exterior of the device is composed of a strong and durable
16 plastic case 30 in a contrasting color such as yellow or light orange~~30~~.

17 Figure 2 shows a block diagram of the mechanism. A removable battery 40
18 provides power~~40~~. It is connected to a small electronic ~~module 50~~. This
19 ~~module~~controller 50. This is a typical embedded microprocessor based controller that
20 reads its program from internal read only memory. When power is applied via an
21 ON/OFF switch ~~80,60~~, and at one second intervals thereafter, the controller reads the

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1 desired device settings from two dials ~~100, 110, 70, 80~~, and from a pair of 8 position DIP
2 switches DP1, DP2 ~~120, 130, 90, 100~~, and uses its internal program and this setting
3 information to drive the ~~blue 60 and red 70~~ red 10 and blue 20 sets of display LEDs (also
4 ~~Figure 1 10, 20). Dial 1 100~~ LEDs. The Frequency Dial 70 controls the mean frequency at
5 which the device ~~changes~~ may change state, which can be varied between 600 transitions
6 per minute and 0.1 transitions per minute. ~~Dial 2 110~~ The Hold Time Dial 80 sets the
7 minimum hold time a device state must be maintained before a state transition is allowed
8 and is variable between 200 milliseconds and ~~5 minutes~~.

9

10 minutes. The switches on DP1 90 and DP2 ~~(120 and 130)~~ 100 control the device
11 in the following manner:

12 DP1,0 determines if the transitions are periodic (fixed rate) or randomly varying around a
13 mean frequency.

14 DP1,1 determines the device state ~~transition~~ order as sequential {0,1,2,3,0...} or random.

15 DP1,2-4 determine the occupancy for device state 0

16 DP1,5-7 determine the occupancy for device state 1

17 DP2,0-1 unused

18 DP2,2-4 determine the occupancy for device state 2

19 DP2,5-7 determine the occupancy for device state 3

20

The occupancy values set on DP1 90 and DP2 100 are integers in the range 0 through 7. The total occupancy for the system is the sum of the four device state occupancies. For instance, if these values were 0,5,3,2 (for states 0 through 3, respectively) the device would never enter state 0, would spend 50% of its time in state 1, 30% in state 2, and 20% in state 3. To vary only between states 1 and 2, and spend equal time (on average) in each the setting would be 0,N,N,0 where N is between 1 and 7. When used in the soccer dribbling drill application a typical setting might be: random transitions with a mean frequency of 15 transitions per minute, a minimum hold time of .5 seconds, random transition order, and occupancies set to 2,7,7,2. It is assumed that situations will arise where the invention will also be used as a static marker in fixed state. To lock the device into state 2 the occupancy values would be set at 0,0,7,0.

~~The table below~~ Table 1 shows the states of the signal lights and their interpretation by the athlete. The first column indicates the state of the red LEDs, the second column the state of the blue LEDs, the third column the device state, and the fourth column indicates the interpretation of the device state to be made by the athlete within the context of a soccer dribbling drill.

TABLE 1

Red Lights	Blue Lights	Device State	Meaning to player
off	off	0	Do not pass
on	off	1	Pass on right side
off	on	2	Pass on left side
on	on	3	Pass on either side

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1 One example of the invention has been described here in detail to comply with the Patent
2 Statutes and to prove that this device could be constructed by one skilled in the arts. It is
3 emphasized that numerous other implementations of the invention are possible, none of
4 which depart from the scope of the invention itself. These include, but are not limited to:
5 utilizing similar or different implementation technologies; utilizing similar or different
6 implementation details, especially presentation of the state to the athlete via alternative
7 means such as symbolic or alphanumeric displays, or synthesized sounds or speech;
8 customizing for one or more different sports; utilizing more or fewer device states;
9 utilizing physically larger or smaller devices; utilizing multiple independent devices
10 simultaneously on the athletic field; utilizing devices which are carried by the athletes or
11 attached to athletic equipment; utilizing remote control of multiple devices which all
12 display the same state; utilizing remote control of multiple devices which display
13 different states; utilizing multiple remote devices which are activated sequentially in a
14 predefined or randomly selected in order to simulate, for instance, the motions of another
15 player; and providing in addition to the display of device state information the selective
16 or broadcast relaying of communications from coaches, referees, ~~and/or other players.~~ or
17 other players.

1 ~~CLAIMS~~

2 ~~1. A device and process for introducing state changes in athletic activities which~~

3 ~~comprises:~~

4 ~~(a) A battery powered electronic device in a suitably durable casing which contains an~~

5 ~~embedded microprocessor based controller utilizing a program loaded from read only~~

6 ~~memory to maintain multiple internal logical states whose combined values define the~~

7 ~~device state. The controller and its program provide: a means for reading the device~~

8 ~~settings from switches and dials interfaced to the controller; a means for varying the~~

9 ~~device state over time; a means for selecting either periodic or randomly timed transitions~~

10 ~~between device states; a means for generating (pseudo)random numbers; a means for~~

11 ~~selecting either periodic or randomly timed transitions between device states; a means for~~

12 ~~selecting either ordered or random progression through the available device states; a~~

13 ~~means for varying the mean transition frequency between device states; a means for~~

14 ~~varying the hold time (the minimum time a device state is maintained); a means for~~

15 ~~varying the relative mean time spent in each device state (device state occupancy); and a~~

16 ~~means for displaying the device state on sets of colored light emitting diodes (LEDs)~~

17 ~~interfaced to the controller, for transmission to the athletes.~~

18 ~~(b) The process which comprises one or more athletes reading the device state~~

19 ~~information from the display of one or more of the devices in (a) and interpreting this~~

20 ~~information within the environment of an athletic training session or an actual game as a~~

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~~local or global change in that environment. Example of a local change: pass the ball to the left of this device. Example of a global change: goal shots are now allowed.~~

~~(c) The device of (a) where the controller and/or display means are mechanical.~~

~~(d) The device of (a) where the controller and/or display means are electromechanical.~~

~~(e) The device of (a) where the controller is electrical.~~

~~(f) The device of (a) where the controller is built from electronic components other than a microprocessor.~~

~~(g) The device of (a) where the local dials and switches are supplemented or replaced by a separate remote control which sends device settings to the controller, which in turn stores and maintains these settings until they are once again changed by the remote control.~~

~~(h) The device of (a) where the periodic signals are generated by an oscillator external to the controller.~~

~~(i) The device of (a) where the generation of random numbers and/or time points is accomplished by measuring physical processes (shot noise, radioactive decay, etc.)~~

~~(j) The device of (a) where the device state is displayed to the athletes by optically active devices other than LEDs, including, but not restricted to, liquid crystal displays, cathode ray tubes, and fluorescent and incandescent bulbs.~~

~~(k) The device of (a) where the device state is presented to the athletes on an alphanumeric ("Pass on left") or symbolic (an arrow pointing left) display.~~

1 ~~(l) The device of (a) where the device state is transmitted to the athletes as one or more~~
2 ~~simple sounds (bells, beeps, buzzes and the like, singly or in combination, simultaneously~~
3 ~~or in sequence.)~~

4 ~~(m) The device of (a) where the device state is transmitted to the athletes as a synthesized~~
5 ~~sound including especially synthesized speech.~~

6 ~~(n) The device of (a) where the device state is transmitted to the athletes as a recorded~~
7 ~~sound including especially recorded speech.~~

8 ~~(o) The device of (a) where the device state is transmitted to a receiver worn by the~~
9 ~~athlete, attached to an article of athletic apparel or equipment, or simply carried by the~~
10 ~~athlete, which displays the device state information for the athlete as in (a) and (j)~~
11 ~~through (n).~~

12 ~~(p) The device of (a) where the controller means are physically separate from, and distant~~
13 ~~from, the display means, with communications between the two parts via wire, fiber~~
14 ~~optics, electromagnetic radiation, or sound waves. Example: multiple devices distributed~~
15 ~~around a large field all displaying the same game state information sent from a single~~
16 ~~controller.~~

17 ~~(q) The device of (p) where different portions of the device state (here referring to the~~
18 ~~device composed of the controller and all remote displays) are presented on specific~~
19 ~~remote display units. Example: multiple goals in a complex field game are set~~
20 ~~individually to indicate whether or not a shot on that goal is allowed.~~

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1 ~~(r) The device of (p) where multiple remote display units are activated sequentially in a~~
2 ~~predefined or randomly selected order so as to present a localized device state change that~~
3 ~~moves in a one, two, or three dimensional pattern across a playing area. Example: an~~
4 ~~athlete on a field containing numerous soccer cones~~
5 ~~incorporating the display moves to "guard" the single active cone, where the order in~~
6 ~~which the cones are lit simulates the motions of a moving offensive player.~~

7 ~~(s) The device (p) where communications from a coach, referee, or other player are~~
8 ~~relayed through the field devices along with the device state to the display units, and~~
9 ~~where such communications may be selectively targeted to any subset of the devices or~~
10 ~~broadcast to all of them. Example: a coach seated high in a stadium first broadcasts a~~
11 ~~message to all players to begin a different type of drill and then directs comments to~~
12 ~~individual players during the course of that drill.~~

13 ~~(t) The devices of (a) through (s) where battery power is supplemented by or replaced~~
14 ~~with solar power and/or line power.~~

1 ABSTRACT OF THE DISCLOSURE

2 A device is described ~~which has means to define and maintain different internal states,~~
3 ~~means to transition at regular or random intervals between those states, means to vary the~~
4 ~~minimum hold time in each state, means to vary the average time spent in each state,~~
5 ~~means to vary the order in which the states are visited, and~~ for introducing variation in
6 athletic training and competitive events. This device maintains an internal state that
7 occupies one of several allowed values. Depending upon the selected configuration, the
8 device changes internal state at regular or irregular intervals, progresses through its
9 allowed values ~~means to externalize and transmit or display the internal state.~~
10 Subsequently sequentially or in random order, and spends a different designated fraction
11 of time in each state. This variable and typically unpredictable state is presented to the
12 field of play where one or more athletes receive ~~this~~ the information and react to it as a
13 change in their athletic training or game environment.

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U.S. PATENT DOCUMENTS CITED:

U.S. Patent No. 3,629,600: EMERGENCY TRAFFIC LIGHT CONTROLLER

U.S. Patent No. 3,933,354: REFLEX TESTING AMUSEMENT DEVICE

U.S. Patent No. 4,702,475: SPORTS TECHNIQUE AND REACTION TRAINING
SYSTEM

U.S. Patent No. 5,325,340: PACING DEVICE

U.S. Patent No. 5,812,239: METHOD AND ARRANGEMENT FOR THE
ENHANCEMENT OF VISION AND/OR HAND-EYE COORDINATION

U.S. Patent No. 5,897,457: ATHLETIC PERFORMANCE MONITORING SYSTEM.

U.S. Patent No. 6,066,105: REFLEX TESTER AND METHOD FOR MEASUREMENT

U.S. Patent No. 6,287,378 B1: PERFORMANCE AND ENTERTAINMENT DEVICE
AND METHOD OF USING THE SAME